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Client Ref. Number: N US03511

Our Case No. 9281-4594

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:

Naoya Hasegawa

Serial No. 10/617,010

Filing Date: July 10, 2003

For Spin-Valve Thin Film Element and
Method for Manufacturing the
Same

)
)
)
) Examiner: Anthony D. Tugbang

)
) Group Art Unit No. 3729

RESPONSE TO OFFICE ACTION

Commissioner for Patents
Alexandria, VA 22313

Dear Sir:

Prior to examination of the above-identified application, please amend the application as follows:

Amendments to the Specification begin on page 2 of this paper.

Amendments to the Claims are reflected in the listing of claims which begins on page 3 of this paper.

Remarks begin on page 5 of this paper.

Amendments to the Specification are as follows:

Please amend the first paragraph of the Specification as follows:

This application is a division of application number 09/491,310, filed January 25, 2000, ~~(pending)~~now U.S. Patent 6,700,750, which is hereby incorporated by reference herein.

Please amend the title as follows:

~~Spin-Valve Thin-Film Element and A Method for Manufacturing the Same~~ Spin Valve

Please amend the abstract as follows:

A method of manufacturing a spin-valve thin-film magnetic element is provided. The spin-valve thin-film magnetic element includes a free magnetic layer and laminates of pinned magnetic layers and antiferromagnetic layers formed on two surfaces of the free magnetic layer. ~~includes biasing and conductive layers and a laminate that includes a free magnetic layer; a first nonmagnetic conductive layer, a first pinned magnetic layer and a first antiferromagnetic layer deposited on the free magnetic layer; a second nonmagnetic conductive layer, a second pinned magnetic layer and a second antiferromagnetic layer deposited on the free magnetic layer. The biasing layers orient the magnetization vector of the free magnetic layer in a direction perpendicular to that of the pinned magnetic layers, and the conductive layers supply a sensing current to the free magnetic layer. The magnetization vectors of the first and second pinned magnetic layers are fixed in antiparallel directions by the first and second antiferromagnetic layers respectively. The first and second antiferromagnetic layers contain Mn and Pt, Pd, Ir, Rh, Ru, Os, Au, Ag, Cr, Ni, Ne, Ar, Xe and/or Kr.~~

Amendments to the Claims

This listing of the claims will replace all prior versions, and listings of claims in the application.

Listing of the Claims:

1 – 9. (Cancelled)

9. (Currently Amended) A method for making a spin-valve thin-film magnetic element comprising:

forming a laminate on a substrate, the laminate comprising a free magnetic layer, two nonmagnetic conductive layers formed on two surfaces of the free magnetic layer, first and second pinned magnetic layers adjoining the two nonmagnetic conductive layers, respectively, and first and second antiferromagnetic layers adjoining the first and second pinned magnetic layers, respectively, the first and second antiferromagnetic layers comprising Mn and at least one element selected from the group consisting of Pt, Pd, Ir, Rh, Ru, Os, Au, Ag, Cr, Ni, Ne, Ar, Xe and Kr, the second antiferromagnetic layer is more proximate to the substrate than the first antiferromagnetic layer;

annealing the laminate at a first annealing temperature while applying a first magnetic field to generate exchange anisotropic magnetic fields in the first and second antiferromagnetic layers such that magnetization vectors of the first and second pinned magnetic layers are fixed in the same direction and such that an exchange anisotropic magnetic field of the second antiferromagnetic layer is larger than an exchange anisotropic magnetic field of the first antiferromagnetic layer; and

annealing the laminate at a second annealing temperature higher than the first annealing temperature, while applying a second magnetic field, which is antiparallel to the first magnetic field, to fix the magnetization vector of the first pinned magnetic layer in a direction which is antiparallel to the magnetization vector of the second pinned magnetic layer.

10. (Previously Presented) A method for making a spin-valve thin-film magnetic element according to claim 9, further comprising setting a magnitude of the second magnetic field to be greater than that of the exchange anisotropic magnetic field of the first antiferromagnetic layer generated by the first annealing and less than that of the exchange anisotropic magnetic field of the second antiferromagnetic layer generated by the first annealing.

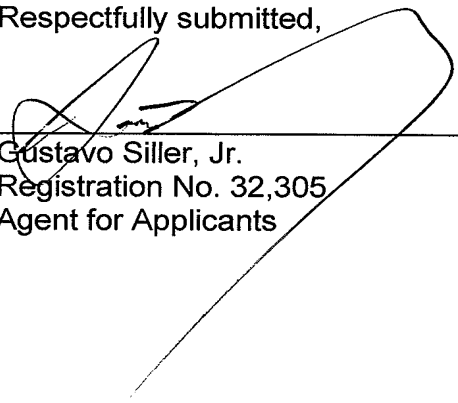
11. (Previously Presented) A method for making a spin-valve thin-film magnetic element according to claim 9, further comprising setting the first annealing temperature to be in a range of 220°C to 250°C.

12. (Previously Presented) A method for making a spin-valve thin-film magnetic element according to claim 9, further comprising setting the second annealing temperature to be in a range of 250°C to 270°C.

REMARKS

Applicants have rewritten portions of the specification and amended Claim 9. The changes are shown with strikethrough for deleted matter and underlining for added matter. No new matter has been added as a result of this amendment. Applicants respectfully submit that all of the pending claims are in condition for allowance and seek an early allowance thereof. If for any reason the Examiner is unable to allow the application in the next Office Action and believes that a telephone interview would be helpful to resolve any remaining issues, he is respectfully requested to contact the undersigned agent or attorney.

Respectfully submitted,



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